Duration: 3hrs **[Max Marks: 80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.
(5) Use of steam table and Mollier Diagram is permitted.

1 Attempt any **FOUR** **[20]**

a Differentiate between Intensive & Extensive properties.

b Explain principle of increase of entropy.

c Define a thermodynamic system. Differentiate between open system, closed system and isolated system

d Draw P-V & T-S diagram for Atkinson cycle and Lenoir cycle.

e Define a) Availability, b) Unavailability, c) Dead state,d) Jouls Thomson Coefficient

f Define the terms a) Sonic Velocity and Mach Number b) Stagnation temperature and Stagnation pressure.

2 a 3 kg of air at 150 Kpa pressure and 360 K temperature is compressed polytropically to pressure 750 Kpa according to the law $pv^{1.2}$= C. Subsequently the air is cooled to initial temperature at constant pressure. This is followed by expansion at constant temperature till the original pressure of 150 Kpa is reached. Sketch the cycle on P-v and T-s plots and determine the work done, heat transfer and entropy change for each process. Take Cv = 0.718 kJ/kg K Cp = 1.005 kJ/kg K and R = 0.287 kJ/kg K. **[10]**

b Define Thermal Reservoir. Difference between heat engine, refrigerator, heat pump. State and explain the Kelvin plank and Clausius statements of the second law of thermodynamics **[10]**

3	**a**	Prove that Steady flow energy equation. Apply to it compressor and Turbine.	**[10]**
	b	(i) State and prove the Clausis theorem.	**[05]**
		(ii) Explain (a) Wet Steam (b) Dry Steam (c) Superheated Steam (d) Degree of Subcooling (e) Saturation Temperature	**[05]**
4	**a**	Steam at 15 bar and 300^0C is throttled to 10 bar before supplying to steam turbine. It then undergoes isentropic expansion to 1 bar in the turbine. Determine isentropic heat drop and the condition of steam at exit from the turbine. Use enthalpy-entropy chart.	**[06]**
	b	(i) Explain the Rankine Cycle with schematic, P-v and T-s Diagram.	**[08]**
		(ii)State limitations of Carnot Vapour Power Cycle	**[06]**
5	**a**	What is Brayton Cycle? Represent this on (p-v) and (T-S) diagram. Derive an expression for cycle efficiency	**[08]**
	b	A steam turbine working on Rankine cycle is supplied with dry saturated steam at 25 bar and the exhaust takes place at 0.2 bar. For a steam flow rate of 10kg/s, determine 1) quality steam at end of expansion, 2) turbine shaft work, 3) power required to drive the pump, 4) work ratio,5) Rankine efficiency.	**[12]**
6	**a**	(i) Explain Stagnation Pressure and Stagnation Temperature	**[05]**
		(ii)State assumptions of air standard cycle.	**[05]**
	b	In a diesel cycle, air 0.1 MPa and 300K is compressed adiabatically until the pressure rises to5 MPa. If 700 KJ/kg of energy in the form of heat is supplied at constant pressure, determine the compression ratio, cut off ratio, thermal efficiency and mean effective pressure. Cp = 1.005 kJ/kg	**[10]**

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